# Casts of the Vagina as a Means of Evaluating Structural Changes and Treatment

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• **A method of making three-dimensional molds of the vagina with the materials used by dentists for oral impressions gives considerably more information about normal and abnormal anatomic features than other methods of study, including direct viewing, palpation and contrast x-ray studies. The molds are of value in the demonstration of anatomic patterns in relation to normal and abnormal functions, in evaluation of surgical and other therapeutic techniques, in teaching, and in explaining the abnormalities and the aims of treatment to patients.**

**The use of such molds is being applied to the study of pelvic prolapse, urinary stress incontinence, sexual function of the vagina and birth injuries.**

ACCURATE TREATMENT of pathologic structural changes of the vagina and its pelvic environs and supports requires a determination of physiologic and anatomic conditions in individual patients for purposes of comparison with what is known of physiologic norms. The present report is of a method of making casts of the shape of the vaginal vault to determine general norms and the departures from normal in disease states. Made serially over a period of treatment, the casts are a useful record of progressive changes by which the effectiveness of therapy can be evaluated.

Current concepts of vaginal anatomy have been arrived at by the classical methods of the anatomist —examination of living subjects, dissection of cadavers, x-ray visualization and histological techniques. Vaginal surgical procedures have been based on observation of anatomic structure with the patient in the lithotomy or supine position and on trial and error, with emphasis on fasciae and ligaments. Sexual physiology of the vagina and its relationship to fertility, to general pelvic function and to female psychology is clouded. The exact mechanisms of urinary control remain illusive and subject to considerable controversy.

Studies by several investigators who gave primary consideration to function have somewhat modified anatomic concepts. Dickinson made careful measurements and drawings from a large number of patients, correlated them with histories and reported them in his atlas published in 1933.[1] He attempted the taking of vaginal impressions on wax cylinders in order to demonstrate muscular patterns. Van de Velde,[10] through careful examination and history-taking, made contributions toward true understanding of sexual function in women. Kegel,[2-9] in his 30-year study of the pubococcygeus muscle, further advanced the knowledge of vaginal and pelvic anatomy in relation to function.

The research here reported was done with Dr. Arnold Kegel, emeritus professor of gynecology at the University of Southern California. It was carried out in the pelvic relaxation clinic at the Los Angeles County General Hospital. Our interest in the physiology of the pelvis as a neuromuscular unit, and in particular the pubococcygeus muscle system and vagina, led to a search for a better method of studying the anatomic features and pathologic variations of the vagina in living subjects. We needed a way to show the actual effect of pubococcygeus muscle exercise in simple pelvic relaxations and urinary stress incontinence, to clearly demonstrate the kinds of injury to the vagina occurring at the time of delivery in order to correlate these injuries with their far-reaching consequences, and to evaluate plastic surgical procedures in the vagina.

Heretofore, findings have been reported in terms of clinical impressions, the patient's reports and perineometric readings.

Our first attempts at making molds of the vagina fortunately coincided with the development of a new material for taking impressions in the oral cavity. It is a powder which forms a rather thick paste when mixed with water. The paste solidifies in about two minutes, forming a resilient, rubbery mold which records detail with extreme accuracy. The material is chemically inert in the vagina and soft enough to permit removal without injury to the patient. The cast obtained is an accurate three-dimensional negative.

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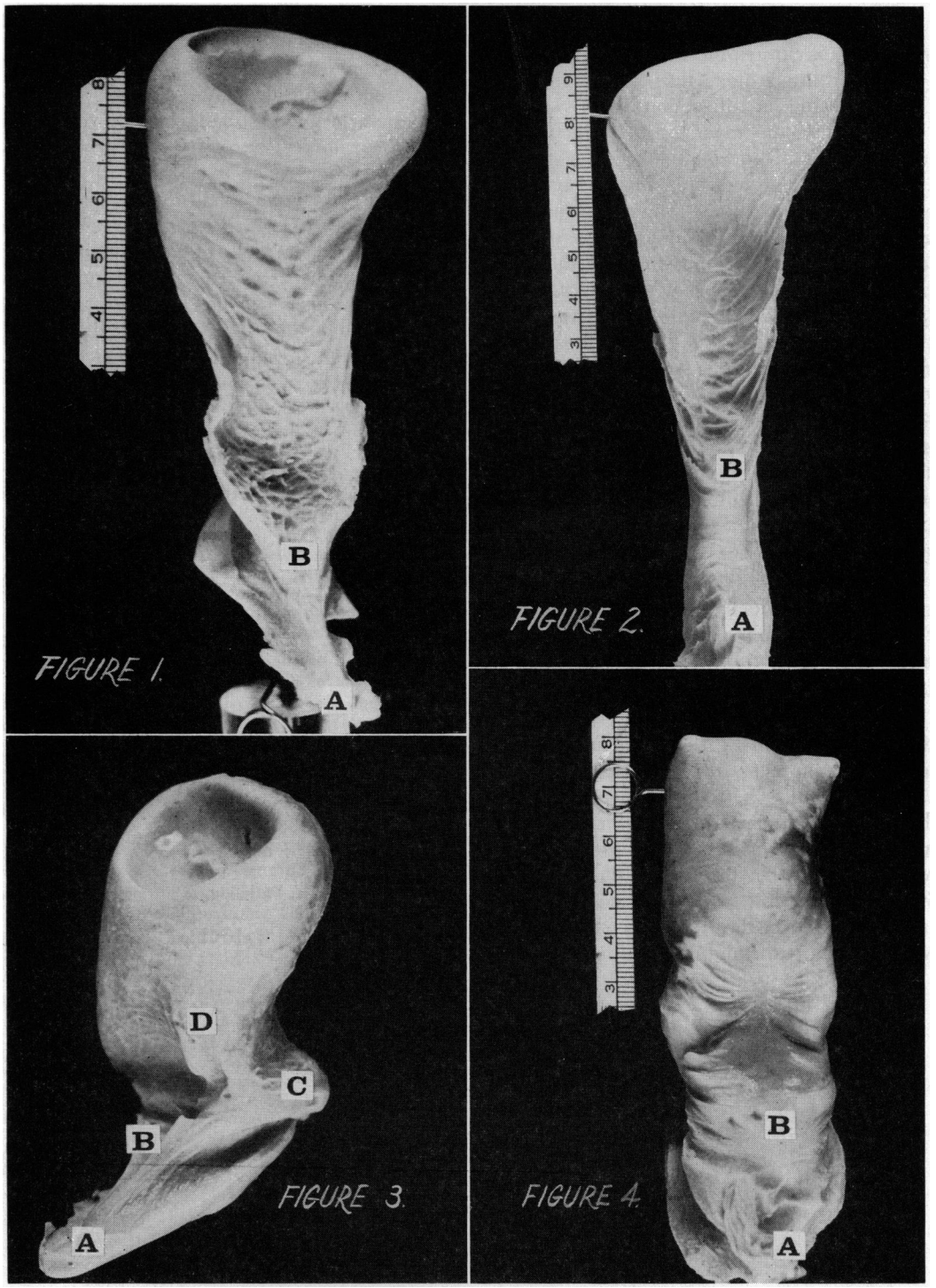


Plate I.—A, Clitoris; B, urethral meatus; C, indication of defect in pubococcygeus muscle; D, indication of scars running to the bladder base. The scales shown are in centimeters. *Figure 1:* Mold of normal vagina, showing symmetrical rugal pattern, muscular constriction of long middle segment and the cervical impression in the wide upper third of the vagina where muscular support is absent. *Figure 2:* Three months after vaginal hysterectomy and anterior and posterior repair. All pelvic functions in the patient were normal. *Figure 3:* Mold of a patient with left mediolateral episiotomy injury, showing indication of a defect in the pubococcygeus muscle and scar tissue running to the region of the bladder base (which caused urinary stress incontinence). The muscular segment is shorter than in a normal vagina. *Figure 4:* The mold shows scarring, distortion and complete loss of rugal pattern (following vaginal hysterectomy and anterior and posterior repair). The patient had urinary incontinence. The muscular segment is replaced by rigid scar tissue and the vaginal vault narrowed.

## TECHNIQUE

The procedure is carried out as follows: After the vagina has been lubricated, the casting material is mixed according to directions and is then drawn into an injector made of a 7/8-inch polyethylene tube with lucite plunger and a rubber washer. The mixture is deposited in the vagina by inserting the injector to the vaginal vault and withdrawing the tube while holding the plunger stationary, care being taken not to force the paste lest pressure change the shape of the organ. While a pad is held against the vaginal orifice just firmly enough to prevent escape of the paste, the patient is put into whatever position is suitable for purposes of the examination—lithotomy, standing, sitting or prone—and is kept in that position for the two minutes necessary for the paste to solidify. Usually the cast is easily removed by pulling gently on it as the patient bears down. But if it is not readily delivered, perhaps owing to a large vault and narrow introitus, the cast can be broken up or can be pushed out by pressure applied rectally.

After inspection photographs are made for permanent records to attach to the patient's chart. Since the casting material shrinks as it dries, the casts themselves are useless as permanent records and should be discarded.

An unexpected advantage that became apparent in the course of our experiments is that it is very simple to make molds with the patient standing. Since this is the position of maximum stress, these molds were more informative than those that were made with the patient in the usual lithotomy position. In normal patients we found no difference between molds made in the lithotomy position and those with the patient standing, but in abnormal situations all degrees of sagging and distortion were shown in casts made with the patient standing.

The molds are a valuable aid in teaching detailed examination of the vagina. After a student examines a patient, a mold is made for him to study, and he then reexamines the patient with the advantage of having seen what he is expected to palpate.

Giving instructions and explanations to a patient is made much easier if she can be shown the differences between a mold of her vagina and one of a normal vagina. The reasons for contemplated surgical procedures can be demonstrated clearly. Letting a patient know that molds will be made from time to time to show the progress of therapy can be a valuable inducement to full cooperation.

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